THE JOURNAL OF ENGINEERING EDUCATION

Published by the Society for the Promotion of Engineering Education

Published monthly, except July and August, under the supervision of the Publication Committee. George B. Pegram, A. A. Potter, F. L. Bishop, Editor, University of Pittsburgh. Published at Prince and Lemon Sts., Lancaster, Pa.

Entered as second-class matter at the Post Office at Lancaster, Pa., under the Act of August 12, 1912.

New Series
Vol. XVI, No. 6. FEBRUARY, 1926 Subscription Price, $3.00 per year. Single Copies, 50 cents.

TABLE OF CONTENTS.

Supplementary Report of the Committee on Teaching Personnel... 419
The Engineering Scene. W. E. Wickenden..... 433
Junior Colleges and Technical Institutes. John T. Faig..... 450
The English Department..... 453
Standardization of Drafting Room Practice..... 458
College Notes..... i

SUPPLEMENTARY REPORT OF THE COMMITTEE ON TEACHING PERSONNEL.

This report supplements the preliminary report of this Committee which was presented to the Society at its meeting of June, 1925, and published in the JOURNAL OF ENGINEERING EDUCATION for December, 1925. It presents in summarized form the results of a study of distribution of teaching loads in the engineering colleges of the United States and Canada. The number of institutions included is 76 and the number of individual teachers is 2,289. The distribution of institutions is shown in Table I. It is believed that the data give a representative and reliable cross-section of conditions in our engineering colleges.

The following comments are offered in order to call attention to certain points which seem to the Committee to be of particular importance. For details the tables and corresponding charts must be consulted.

Probably the first comment made by those familiar with educational administration will be that the average teaching loads (number of hours of required attendance in class or laboratory per week) for all grades of engineering teachers is much heavier than that of academic teachers, or at least heavier than the latter are commonly supposed to be, since comparative statistics are not available. The general average, from which departures for the various grades are surprisingly small, is 17.6 (Tables II and III) or practically 18 hours per week. Excluding the Deans the average lead is exactly 18.0 hours per week. It is interesting to note that if the average length of the class room hour be taken at 55 minutes, the teaching load for engineering teachers (excluding Deans) is 990 minutes per week, which is very close to the average of high school teachers carrying a full schedule of 1,000 minutes per week.

Opinions will differ as to whether this teaching load is, or

is not, too heavy. Indeed there is some difference of opinion on this point among the members of this Committee. The majority feel that 18 hours per week is too heavy a load, and that it should not, at least for the higher ranks, exceed 15 hours per week.

Everyone familiar with the situation knows that the number of hours of actual attendance in class room and laboratory is by no means an accurate indication of the demands upon the teacher's time. To this must be added the time required for preparation for classes and for the planning of problems, projects and experiments; the time required outside of class hours, for the maintenance and operation of laboratories; and the time required for correction of problems, reports and examinations. To this must be added the time, often considerable, devoted to conferences and committee assignments. It is very difficult to estimate the time required for these supplementary duties, nor has any effort been made to determine it statistically because it was not believed possible to do so accurately. But it is probably quite within the limits of accuracy to state that for the teacher who carries on his work conscientiously and assists to a reasonable degree in the committee activities of an engineering college the time required outside of the class room is at least equal to that in the class room. It must also be remembered that the hours of actual class room attendance during the week are not scheduled as a single block but that they come at irregular intervals both in the morning and afternoon, breaking up the day unprofitably as far as really free time is concerned. It hardly seems possible that there remains a sufficient margin of time for the teacher to develop his professional contacts or to improve his professorial standing or for general growth and self-development.

The data bring out one rather surprising fact, namely, that each rank carries a teaching load which is in almost exact proportion to the number of teachers in that rank. (Table II and Fig. 1.) The division of teaching staffs as to rank seems on the whole to be quite satisfactory. Deans and Professors

constitute 28.2 per cent. of the total, Associate and Assistant Professors 32.3 per cent. and Instructors 33.5 per cent. The percentage of men of the rank of "Assistant" is small—4.2 per

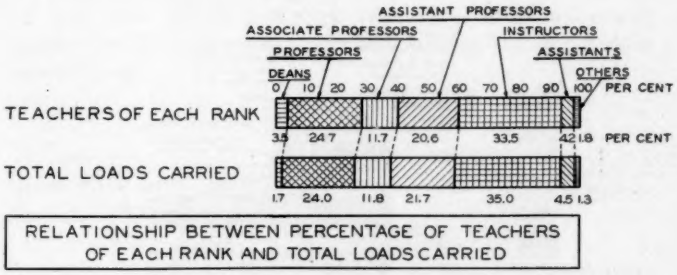
ASSISTANT PROFESSORS
ASSOCIATE PROFESSORS
INSTRUCTORS
PROFESSORS
ASSISTANTS
DEANS
OTHERS
0 10 20 30 40 50 60 70 80 90 100 PER CENT
TEACHERS OF EACH RANK
3.5 24.7 11.7 20.6 33.5 42 1.8 PER CENT
TOTAL LOADS CARRIED
1.7 24.0 11.8 21.7 35.0 4.5 1.3
RELATIONSHIP BETWEEN PERCENTAGE OF TEACHERS OF EACH RANK AND TOTAL LOADS CARRIED

FIG. 1.

cent, probably not greater than the amount of work which should properly be delegated to these younger men. The small proportion of teachers of this rank should be borne in mind in studying the division of teaching loads.

It is rather striking that while there is, as would be expected, a considerable increase in the load of laboratory, drafting room and shop work as the lower teaching grades are approached, and that a relatively larger proportion of the time of teachers of junior rank is devoted to freshmen and sophomores, there is on the whole a rather general participation of all ranks in all kinds of instructional work. (Tables III and IV, Fig. 2 and 3.) In this connection special attention may be called to the work of teachers of the rank of "Assistant." It will be noted that there are but 95 such teachers in the 76 institutions reporting and that while they devote an average of 19.3 hours per week to definitely assigned duties, 15.9 hours of this total are devoted to laboratory, field, shop and research work, but 0.9 hours per week to actual class room teaching and 2.5 hours per week to drafting and design courses. This matter is mentioned specifically in order to disprove the statement which is sometimes heard that a significant proportion of the

teaching of engineering students is carried on by student-assistants and graduate students.

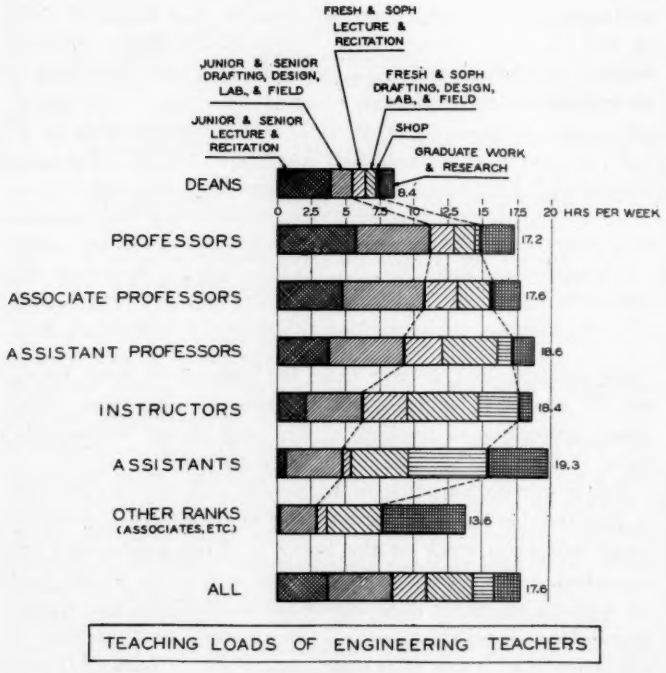

FIG. 2.

Some will feel that a larger participation of the Professors and Associate Professors in the teaching of freshmen and sophomores is desirable. On the other hand there are some who feel rather strongly that the mature Instructors and the Assistant Professors, that is to say that part of the staff which has had a fair amount of teaching experience and is somewhat nearer to the students in years and point of view, are quite as likely to achieve satisfactory results with the freshmen and

sophomores as are the older teachers. All will probably agree that it is important to guard against any increase in the proportion of younger and less experienced teachers assigned to the important task of teaching the elementary subjects; in fact they should not teach such subjects at all except under the most careful supervision and guidance of those above them.

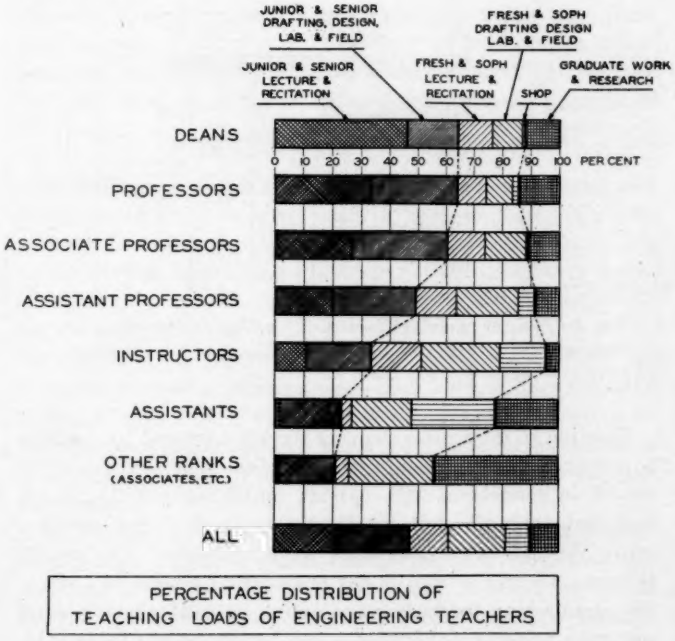
JUNIOR & SENIOR DRAFTING, DESIGN, LAB. & FIELD
FRESH & SOPH DRAFTING DESIGN LAB. & FIELD
JUNIOR & SENIOR LECTURE & RECITATION
FRESH & SOPH LECTURE & RECITATION
SHOP
GRADUATE WORK & RESEARCH
DEANS
PROFESSORS
ASSOCIATE PROFESSORS
ASSISTANT PROFESSORS
INSTRUCTORS
ASSISTANTS
OTHER RANKS (ASSOCIATES, ETC.)
ALL
0 10 20 30 40 50 60 70 80 90 100 PER CENT
PERCENTAGE DISTRIBUTION OF TEACHING LOADS OF ENGINEERING TEACHERS

FIG. 3.

The tables show that the time devoted to the instruction of graduate students is small throughout the country as a whole, and point to the fact that our engineering education is still predominantly undergraduate in character. This is the case in spite of the fact that a very considerable proportion of the

institutions offer graduate courses in engineering. It is of course true that many of the larger and stronger institutions give a considerable amount of graduate instruction. This must mean that many engineering schools are giving very little or none at all in order to bring the average down to the small figure shown in the tables.

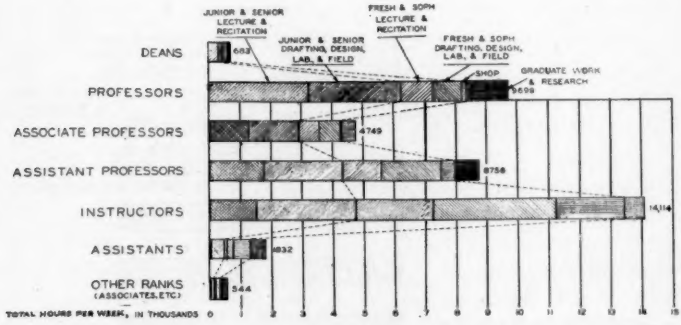

FIG. 4. Diagram showing division of teaching duties among teachers of various ranks. Length of bar is proportional to total teaching load of corresponding rank. See Table V.

Turning to the figures showing the time devoted by teachers to research work, it should be noted that time devoted to research in connection with outside consulting practice is not included, since this was specifically excluded in the questionnaire through which the data were collected. The results indicate, we take it, that in our engineering schools as a whole the engineering teacher is not active in research, 1.3 hours per week being the general average for all ranks (Table III). The *percentage* of the teacher's time devoted to research has little significance, it is the *actual* time spent that should be looked at. If we connect this with the fact, also brought out by this investigation, that the amount of outside professional work is not large on the whole, we must conclude that engineering teachers as a group are mainly occupied with their

teaching duties. This, in our opinion, is the inevitable outcome of the heavy load of class room duties which the teachers carry.

Again as in the case of graduate study we must call attention to the well-known fact that in the larger and stronger schools a very considerable amount of time is devoted by many members of the teaching staff to research work, so that in order to produce the very low averages for time actually spent in research, there must be many institutions where very little time is spent in this way. This is not an encouraging situation. It may point to too heavy teaching loads, but we fear also that it points to the fact that there is not that degree of intellectual activity and vitality among our engineering teachers as a class which promises a transmission to the student of that enthusiasm and love for independent thinking and investigation which is so necessary to real progress. We may perhaps find some comfort in the fact that the Assistants are on the average spending 4.4 hours per week on research work. This means, of course, that many of these Assistants are working for advanced degrees, one requirement for which is investigation of a research character. While this shows an intention at least to encourage research work, it does not indicate that engineering research has any conspicuous place in the programs of our colleges, since the number of assistants is so small, being but little more than an average of one per institution.

In its report of June, 1925, your Committee presented tabulations and diagrams which summarize data regarding the earnings of engineering teachers. (See JOURNAL OF ENGINEERING EDUCATION for December, 1925.) In this the supplementary report, there is presented a diagram showing a comparison of earnings of engineering teachers and engineering graduates (Fig. 5). This diagram is based upon returns supplied by 2,289 teachers and by 5,023 graduates. The data are believed to be accurately representative. The situation presented by this diagram is so striking as hardly to call for

comment. It seems obvious that improvement in the financial status of teachers is essential to any marked improvement in the quality of teachers and of teaching.

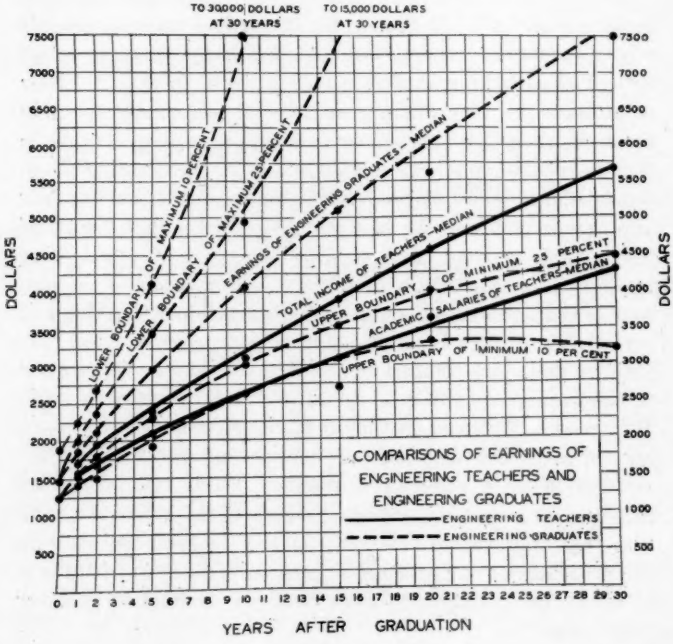
TO 30,000 DOLLARS AT 30 YEARS
TO 15,000 DOLLARS AT 30 YEARS
LOWER BOUNDARY OF MAXIMUM 10 PERCENT
LOWER BOUNDARY OF MAXIMUM 25 PERCENT
EARNINGS OF ENGINEERING GRADUATES - MEDIAN
TOTAL INCOME OF TEACHERS - MEDIAN
UPPER BOUNDARY OF MINIMUM 25 PERCENT
ACADEMIC SALARIES OF TEACHERS - MEDIAN
UPPER BOUNDARY OF MINIMUM 10 PER CENT
COMPARISONS OF EARNINGS OF ENGINEERING TEACHERS AND ENGINEERING GRADUATES
ENGINEERING TEACHERS
ENGINEERING GRADUATES
DOLLARS
YEARS AFTER GRADUATION

FIG. 5.

In conclusion, and referring at this time only to the matter of teaching loads and their division among teachers of various ranks, your Committee is disposed to recommend first, that the teaching loads be reduced so that the regulation load shall not exceed in general fifteen hours of actual attendance in the class room per week, believing that with a smaller teaching load the quality of teaching would improve and that there would be a corresponding increase in the time devoted to research if, of course, an effort were made to secure and retain

teachers who showed an interest in doing research work; second, that a larger proportion of the work of freshman and sophomore classes be given by teachers of senior rank and that less be given by the less experienced instructors and assistants.

It will doubtless be remarked at this stage that such recommendations are all very well and easy to make, but that they call for larger staffs which means more money. This is probably true, but we venture to think that some advance could be made in the direction indicated by reducing the numbers of students unfitted to take up engineering work at all, and perhaps also by readjusting our methods of teaching so that the students would do more *learning* and the teachers less teaching of a formal sort.

For the Committee,

C. H. WARREN, *Chairman*,
W. H. KENERSON, *Secretary*.

TABULATIONS SHOWING DISTRIBUTION OF TEACHING LOAD.

Only those teachers who report to the Dean of Engineering are included in the tables.

Project Ab1, Part 3.

TABLE I.

State Universities (Includes Land Grant and Non-Land Grant)	25	New England and Middle Atlantic States	24
Land Grant Colleges	14	Southern States	16
Other State Institutions	3	Mid-Western States	22
Municipal Institutions	2	Rocky Mountain States	8
Independent Universities	18	Pacific Coast States	3
Independent Polytechnic Institutes	6	Canada	3
Independent Arts Colleges	4		
Independent Military Colleges	1		
Canadian Institutions	3		
	76		76

TABLE II.

DISTRIBUTION OF TEACHERS OF VARIOUS RANKS AND TOTAL NUMBER OF HOURS PER WEEK OF TEACHING DUTIES CARRIED.

	No. of Teachers of Each Rank.	Per Cent. of Total No. of Teachers.	Per Cent. of Total Load Carried.	Load—No. of Hours* per Individual per Week.
Deans or Directors	81	3.5	1.7	8.43
Professors	565	24.7	24.0	17.2
Associate Professors	269	11.7	11.8	17.6
Assistant Professors	472	20.6	21.7	18.6
Instructors	767	33.5	35.0	18.4
Assistants	95	4.2	4.5	19.3
Other Ranks (Associates, etc.)	40	1.8	1.3	13.6
TOTALS	2,289	100.0	100.0	Average 17.6

* An "hour" is a college period of from 50 to 55 minutes.

TABLE III.

DISTRIBUTION OF TEACHING DUTIES IN HOURS* PER WEEK FOR TEACHERS OF EACH RANK.

Rank.		Lectures and Recitations.		Drafting and Design.		Laboratory and Field.		Shop.	Graduate Courses.	Research Work.	Total.
		Jun. and Senior.	Fresh. and Soph.	Jun. and Senior.	Fresh. and Soph.	Jun. and Senior.	Fresh. and Soph.				
Deans or Directors	Hours...	3.89	1.01	0.73	0.42	0.81	0.47	0.05	0.44	0.61	8.43
	Per Cent.	*46.1*	*12.0*	*8.6*	*5.0*	*9.6*	*5.6*	*0.6*	*5.3*	*7.2*	*100.0*
Professors	Hours...	5.7	1.8	2.5	0.7	2.8	0.9	0.3	1.0	1.5	17.2
	Per Cent.	*33.1*	*10.3*	*14.6*	*4.2*	*16.2*	*5.1*	*1.8*	*5.8*	*8.9*	*100.0*
Associate Professors	Hours...	4.7	2.3	2.0	1.2	4.0	1.3	0.06	0.8	1.2	17.6
	Per Cent.	*26.9*	*13.3*	*11.3*	*7.0*	*22.6*	*7.5*	*0.3*	*4.5*	*6.6*	*100.0*
Assistant Professors	Hours...	3.7	2.7	1.3	2.1	4.2	2.0	1.0	0.4	1.2	18.6
	Per Cent.	*20.2*	*14.4*	*6.9*	*11.3*	*22.3*	*10.7*	*5.6*	*2.3*	*6.3*	*100.0*
Instructors	Hours...	2.0	3.2	0.8	2.5	3.4	2.7	2.9	0.1	0.8	18.4
	Per Cent.	*10.8*	*17.5*	*4.4*	*13.6*	*18.5*	*14.4*	*15.9*	*0.7*	*4.2*	*100.0*
Assistants	Hours...	0.3	0.6	0.6	1.9	3.6	2.2	5.7		4.4	19.3
	Per Cent.	*1.6*	*3.5*	*3.0*	*9.7*	*18.6*	*11.5*	*29.5*		*22.6*	*100.0*
Other Ranks	Hours...	0.1	0.7		0.2	2.7	3.9		0.3	5.7	13.6
	Per Cent.	*1.1*	*4.8*		*1.5*	*20.0*	*28.3*		*2.2*	*42.1*	*100.0*
Average—All Ranks Combined	Hours...	3.6	2.4	1.4	1.7	3.4	1.8	1.5	0.5	1.3	17.6
	Per Cent.	*20.2*	*13.7*	*8.1*	*9.6*	*19.1*	*10.4*	*8.6*	*2.8*	*7.5*	*100.0*
Total—Deans not included	Hours...	3.5	2.5	1.5	1.7	3.5	1.9	1.6	0.5	1.3	18.0
	Per Cent.	*19.4*	*13.9*	*8.3*	*9.5*	*19.4*	*10.6*	*8.9*	*2.8*	*7.2*	*100.0*

* An "hour" is a college period of from 50 to 55 minutes.

TABLE IV.

DIVISION OF VARIOUS TYPES OF INSTRUCTION OF UPPER AND LOWER CLASSES AMONG TEACHERS OF VARIOUS RANKS.

(Instruction given by teachers who do not report to the engineering dean is not included in the table.)

Rank.	Teachers of Each Rank, %.	Lectures and Recitations.		Drafting and Design.		Laboratory and Field.		Shop, %.	Graduate Courses, %.	Research Work, %.	Total. %.
		Jun. and Senior, %.	Fresh. and Soph., %.	Jun. and Senior, %.	Fresh. and Soph., %.	Jun. and Senior, %.	Fresh. and Soph., %.				
Deans or Directors	3.5	3.9	1.5	1.8	0.9	0.9	0.9	0.1	3.2	1.6	1.7
Professors	24.7	39.4	18.1	43.0	10.6	20.4	11.7	5.1	49.7	28.6	24.0
Associate Professors	11.7	15.7	11.4	16.4	8.6	13.8	8.5	0.4	19.3	10.4	11.8
Assistant Professors	20.6	21.7	22.8	18.4	25.6	25.3	22.3	14.2	17.5	18.3	21.7
Total Professorial Rank	60.5	80.7	53.8	79.6	45.7	60.4	43.4	19.8	89.7	58.9	59.2
Instructors	33.5	18.8	44.6	18.7	49.5	33.8	48.0	64.7	9.2	19.7	35.0
Assistants	4.2	0.4	1.1	1.7	4.6	4.4	5.0	15.5		13.8	4.5
Other Ranks	1.8	0.1	0.5		0.2	1.4	3.6		1.1	7.6	1.3
Total: Instrs., Assts. and Others	39.5	19.3	46.2	20.4	54.3	39.6	56.6	80.2	10.3	41.1	40.8
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE V.

CONDENSED SUMMARY OF DATA SHOWN IN PRECEDING TABLES.

Rank.	Teachers of Each Rank.		Lectures and Recitations.				Drafting and Design.				Laboratory and Field.			
			Jun. and Senior Hours.		Fresh. and Soph. Hours.		Jun. and Senior Hours.		Fresh. and Soph. Hours.		Jun. and Senior Hours.		Fresh. and Soph. Hours.	
	No.	%.	No.	%.	No.	%.	No.	%.	No.	%.	No.	%.	No.	%.
Deans or Directors	81	3.5	315	3.9	82	1.5	59	1.8	34	0.9	66	0.9	38	0.9
%				46.1		12.0		8.6		5.0		9.6		5.6
Professors	565	24.7	3214	39.4	1001	18.1	1410	43.0	410	10.6	1574	20.4	495	11.7
%				33.1		10.3		14.6		4.2		16.2		5.1
Associate Professors	269	11.7	1278	15.7	631	11.4	537	16.4	331	8.6	1070	13.8	357	8.5
%				26.9		13.3		11.3		7.0		22.6		7.5
Assistant Professors	472	20.6	1768	21.7	1263	22.8	603	18.4	988	25.6	1955	25.3	940	22.3
%				20.2		14.4		6.9		11.3		22.3		10.7
Instructors	767	33.5	1532	18.8	2474	44.6	615	18.7	1918	49.5	2612	33.8	2026	48.0
%				10.8		17.5		4.4		13.6		18.5		14.4
Assistants	95	4.2	30	0.4	63	1.1	55	1.7	178	4.6	341	4.4	210	5.0
%				1.6		3.5		3.0		9.7		18.6		11.5
Other Ranks	40	1.8	6	0.1	26	0.5			8	0.2	109	1.4	154	3.6
%				1.1		4.8				1.5		20.0		28.3
TOTALS	2289	100.0	8143	100.0	5540	100.0	3279	100.0	3867	100.0	7727	100.0	4220	100.0
%				20.2		13.7		8.1		9.6		19.1		10.4

TABLE V. *Continued.*

Rank.	Teachers of Each Rank.		Shop Hours.		Graduate Course Hours.		Research Work Hours.		Total Hours.		Hours per Individual per Week.
	No.	%.	No.	%.	No.	%.	No.	%.	No.	%.	
Deans or Directors	81	3.5	4	0.1	36	3.2	49	1.6	683	1.7	8.43
%			0.6		5.3		7.2		100.0		
Professors	565	24.7	178	5.1	557	49.7	860	28.6	9699	24.0	17.2
%			1.8		5.8		8.9		100.0		
Associate Professors	269	11.7	15	0.4	216	19.3	314	10.4	4749	11.8	17.6
%			0.3		4.5		6.6		100.0		
Assistant Professors	472	20.6	492	14.2	196	17.5	551	18.3	8756	21.7	18.6
%			5.6		2.3		6.3		100.0		
Instructors	767	33.5	2244	64.7	103	9.2	590	19.7	14114	35.0	18.4
%			15.9		0.7		4.2		100.0		
Assistants	95	4.2	540	15.5			415	13.8	1832	4.5	19.3
%			29.5				22.6		100.0		
Other Ranks	40	1.8			12	1.1	229	7.6	544	1.3	13.6
%					2.2		42.1		100.0		
TOTALS	2289	100.0	3473	100.0	1120	100.0	3008	100.0	40377	100.0	17.6
%			8.6		2.8		7.5		100.0		

THE ENGINEERING SCENE.*

A Critical Glance at Technical Education in Europe and How We may Profit by It.

BY WILLIAM E. WICKENDEN,

Director of Investigation, Society for the Promotion of Engineering Education.

Exercising every caution for the avoidance of extravagant speech, **The Review** Editors still believe that it is a fair statement to say that at no time in the past has **The Review** been privileged to publish an article so absorbing in its style or so vital in its content as "The Engineering Scene." Mr. Wickenden, recently returned to this country after an eight-month study of technical education in England and on the Continent, has succeeded to an extraordinary degree in recreating the picture which he saw.

Mr. Wickenden's stay in Europe was but one phase of the international investigation of technical education which he is directing on behalf of the Society for the Promotion of Engineering Education. Readers of this article will discover a fine balance between the statement of conditions abroad and conditions at home. They will find plain and unvarnished home truths which lunge heavily at the complacency of many of our American institutions. Technology, itself, he does not spare. We quote one of his forceful paragraphs:

"Technology, for all the preëminence and prestige with which it has carried out its chosen mission, cannot be wholly absolved from this criticism. I find as I move about in the wider circles of our technical education that the Institute has something of a reputation for aloofness. Some are even unkind enough to call it complacency and self-satisfaction. It is very easy and natural to feel little concern to help the other fellow or learn from him when one is conscious of doing his own job well. However, I am glad of this chance to pay a tribute to my former chief and present co-worker, Professor Jackson, and to that prince of Technology Alumni, Mr. Calvin W. Rice, '90, National Secretary of the American Society of Mechanical Engineers, who stand out in bold relief in keeping the Institute in active touch with the wider movements in technical education.

"The result of this preoccupation with detail and unconcern with the general situation of which all of us have been guilty is that we have gotten a national, standardized system of technical education by sheer imitation and not by intelligent design. A few great pioneer institutions, carefully designed by their founders to fit the educational and economic needs then existing, have been uncritically copied from one end of the land to the other. The result is a woefully top-heavy system. We have too many institutions attempting pretentious programs of advanced professional training, and nowhere near enough giving substantial industrial training intermediate between the high schools and the professional schools of engineering."

The American and Canadian engineering colleges—120 strong—are now engaged in a large scale study, aiming at

* The Technology Review, Vol. XXVIII, No. 3, p. 143–148.

readjustments of organization and practice which will make them more efficient factors in our educational and economic life. It was my privilege to spend eight months in Europe as their representative. One begins such a mission by expecting to find some things done better, which we may borrow or imitate to our profit. He ends by finding the possibilities of direct borrowing to be very scant indeed. The fundamental conditions are different. Educational systems are organisms, not machines. They are evolved rather than assembled by deliberate design. They cannot be disassociated from the economic and cultural environment in which they have developed. They cannot be taken apart and transplanted piecemeal.

I.

The first thing that an observer discovers is that his task goes beyond the mechanics of plant and curriculum, the details of teaching and examination, important as they are, to the broader problem of technical education as a factor in the economic programs of the several nations. The value of such a study has to be found in the detached base-line it affords for a criticism of our own work. The most general criticism of our engineering education that I have to make is that we have conceived it too narrowly, too much as a type of teaching process and too little as a vital factor in our economic life. We have been so preoccupied with our own subjects, our own departments, our own institution, that we have given all too little thought to technical education as a whole.

Technology, for all the preëminence and prestige with which it has carried out its chosen mission, cannot be wholly absolved from this criticism. I find as I move about in the wider circles of our technical education that the Institute has something of a reputation for aloofness. Some are even unkind enough to call it complacency and self-satisfaction. It is very easy and natural to feel little concern to help the other fellow or learn from him when one is conscious of doing his own job well. However, I am glad of this chance to pay a tribute to my former chief and present co-worker, Professor Jackson,

and to that prince of Technology Alumni, Mr. Calvin W. Rice, '90, National Secretary of the American Society of Mechanical Engineers, who stand out in bold relief in keeping the Institute in active touch with the wider movements in technical education.

The result of this preoccupation with detail and unconcern with the general situation of which all of us have been guilty is that we have gotten a national, standardized system of technical education by sheer imitation and not by intelligent design. A few great pioneer institutions, carefully designed by their founders to fit the educational and economic needs then existing, have been uncritically copied from one end of the land to the other. The result is a woefully top-heavy system. We have too many institutions attempting pretentious programs of advanced professional training, and nowhere near enough giving substantial industrial training intermediate between the high schools and the professional schools of engineering. Germany, with her 65,000,000 people and her intensive industrial system, makes out with ten polytechnic schools and two mining schools of university grade, but there are between twenty and thirty admirable *Technicums*, middle schools of the Pratt Institute type, enrolling in the aggregate as many or more students than the schools of highest grade. In Great Britain the contrast is even more striking, it is positively the reverse of our situation. Students of engineering schools of university grade do not exceed 2,500 in the aggregate, while the number in technical schools of junior and intermediate grade is between ten and fifteen times as great.

The top-heavy situation in America is further revealed by the fact that the majority of the students entering our technical colleges find the elaborate four-year program to be an impossible program. Out of one hundred freshmen who enter an average engineering college, only twenty-nine will be in ceed by taking an extra year and some will be replaced by men coming on advance standing from the arts colleges, but nearly two-thirds of the entire lot go through the sieve and get their preparation for life by failing to reach their objective. One

resourceful advisor of freshmen puts the prospect up to them in a very concrete form. He says: "Now, fellows, let's visualize this thing. Each of you look at the man at your left—when you come back next year, he'll not be here. Now turn the other way and look at the man on your right—when commencement day comes, he'll not graduate."

There are valuable by-products, of course, but altogether too much waste—waste of costly educational facilities and tragic waste of the irreplaceable years of youth. The evidence we have been gathering in this country and abroad is leading me to the conviction that we need better engineers, a smaller number of men than we are now graduating with decidedly better training, and that we need a much larger group with a briefer, more intensive and more practical training. We need to give the majority of the students who flock to our engineering colleges a less elaborate program at which to succeed instead of fail, but we need to give the minority, and perhaps an even smaller minority than at present, who survive to graduation, a broader as well as a deeper training. The whole structure of our technical education needs more elasticity, if it is to meet the needs of our youth on one hand and the needs of our industry on the other.

II.

But we are supposed to be discussing Europe rather than America. If one were to judge by the visible scars which remain he could never make himself believe that Europe had experienced any such cataclysm as the late war. The material restoration of the ravaged areas is nearly complete. The mines and industries of northern France are now well above the pre-war level of production. Germany engineered the inflation period so as to completely liquidate the middle classes and to fix her negotiable wealth in a form which could not be removed from the country. Consequently her industrial equipment and her transport facilities, by highway, water and rail alike, are in an admirable state of renovation. In Italy the Facisti have undertaken a program of reclamation of land

and development of resources on a most extraordinary scale, aiming at a goal no less than the making in Italy of a home for the fast multiplying Italian people.

The people, too, conceal their scars. When one recalls the millions of mutilated and the tens of millions of wounded, the occasional sight of a wooden leg, an empty sleeve or a glass eye, gives but a slight hint of the miseries endured. The vigorous appearance of practically all classes in Germany and Austria makes it hard to believe that the two nations went literally to the very edge of starvation. So great is the natural crowding of population that the wastage of manpower can not be discerned superficially.

To a surprising degree, too, the people conceal their spiritual scars under an exterior of cheerfulness and optimism. There are endless signs of petty economy of dress, such as the prevalence of celluloid collars, of frugality of eating; such as the habit of carefully mopping up all gravy from the plate with bits of bread, and of saving on transportation, such as the overcrowding of the cheaper conveyances, but through it all British phlegm, French urbanity, German dignity, Austrian *gemütlichkeit* and Italian spontaneity are pretty much what they used to be. The Europe of today is an amazing testimony to the inherent resiliency of human nature and to the no less remarkable resiliency which modern industrial science has given to the economic system.

The legacies of the war are plainly social, political, and economic. Individuals are much the same as before, but institutions are profoundly shaken. If one would understand the present trends of technical education abroad he must do so in the light both of tradition and national programs of industrial recovery and expansion.

One would seek in vain for indications of a program of expansion in the upper levels of French technical education. Admission to the conspicuous schools, especially those in Paris, is eagerly sought for, but is rigidly restricted and intensely competitive. The French consider it both wise and just, in a land already highly developed and having no great program

of industrial aggrandizement, to protect the engineering profession from dilution by definite restriction at the source of recruitment. Higher technical education, like all other higher education in France, has a strong intellectual bias. Admission is restricted to a selected elite. The schools pride themselves on the professional distinction of their professors, most of whom are not teachers by career but active practitioners who receive only nominal salaries and serve primarily for honor. The instruction has a strong mathematical and theoretical emphasis, partially balanced by the solution of engineering problems of substantially real magnitude. French laboratories, for the most part, are rather meagre. A few of the most modern installations indicate that the French know how it should be done, and give support to the ever-present excuse of public poverty.

These characteristic virtues—teachers of high intellectual and professional distinction, restriction of admission to the mentally gifted, great theoretical emphasis and a régime of almost military rigor—together with the corresponding defects, such as paucity of material equipment, meagreness of practical experience, absence of an adequate recreational life and the lack of organized student activities to provide a sort of experiment station for self-discovery and self-expression, run all through French secondary and higher education.

Technical education of the middle grade, so meagrely developed in America, is relatively well provided for in France and is of excellent quality. The French have dignified technical education by the appointment of a special under-secretary of state, but the great efforts of his office are devoted to the development of an adequate national system of apprenticeship for the manual crafts.

The great tenacity of French character is equally manifested in her economic program and her educational program. Quality and not quantity production, skilled handcraft and not standardized specialization of labor, organization on a modest scale and not mass organization, bid fair to remain the industrial ideals of France. Intellectual distinction rather than

practicality bids fair to remain her educational ideal. France is striving to remain France, a land of internally balanced economic life, where agriculture is the dominant industry, where the drain on natural resources is fairly light, where wealth is the reward of thrift rather than the fruit of great exploitation, where individualism prevails over mass organization, where science is cultivated primarily for intellectual satisfactions, and where the things of the spirit are preferred to a lavish scale of material existence. France prefers to remain France, if it need be at the risk of national life. She wants to work out her financial problem through time and thrift, as she has always done. Security is her first requisite and the second, a long-term funding of her debts. Given these, France is in the most secure and favored position of any of the great powers. Without them her position is the most precarious.

III.

There is a definite change of atmosphere as one passes over the border from France to Italy. Where France is carefully measuring her strength for the long pull, the mood of Italy is one of exuberance. You know the romantic story of Fascism. It was not a choice between dictatorship and constitutional government. The choice was between chaos and order, between the red flag of communism and the black shirt of semi-military discipline. With all its abuses, its intimidation, its fantastic ambitions to recreate the ancient Roman empire, the Mussolini régime is attacking the staggering economic problem of Italy with a boldness which compels whole-hearted admiration.

To picture what Italy must contend against, let us take the area of New Hampshire, Vermont, New York, New Jersey and Pennsylvania. Let us take out all the coal and oil and all but a small fragment of the metalliferous ore. Let us strip off practically all of the forests and leave one third of the entire area non-arable mountain land. Let us turn most of New Jersey into a region so arid that a peasant at some seasons would give a wayfarer a drink of wine rather than a drink of water.

Let us mark off the area of Vermont as swamps and marshes. Now let us double the population and set it to increasing one per cent each year with compound interest, wipe out about three fourths of the existing wealth and pile on a huge war debt.

Now it is against such handicaps as these that Italy is trying to make of herself and her north African colony an adequate home for Italians. It is an engineering problem on a truly national scale. The program calls for the drainage of all swamps, the destruction of mosquitos and other sanitary hazards, the development of all water-powers, and the irrigation of Calabria with water brought hundreds of miles from the distant Apennines. It calls for a great program of railroad electrification. It calls for the reclamation and repopulation of Sardinia which was a great granary in Roman days, but later was decimated by malaria. It means the development of the new waste land of Lybia for the growing of wheat and cotton. It means the development of manufacturing on the lines so intelligently followed in Switzerland and through the application of a maximum of technical knowledge and highly skilled labor to a minimum of imported raw materials, as in watch and clock making.

While it would be plainly improper to rank Italy at the front of the great powers of Europe, she probably leads them all in her present rate of material progress. Higher technical education has been in the direct path of this movement. Italy is par excellence a land of builders. Her traditions and her program give civil engineering a dominant place, but electrical engineering is coming to the fore as a strong second. The other branches are developing slowly and are still far in the rear, unless it be naval architecture, in which the Italians have great ambitions.

The polytechnic schools of Italy, like those of Germany, are coördinate with the universities. The first two years of the five-year course may be taken in either type of institutions In point of equipment, personnel, standards and morals the Italian polytechnics quite outran my expectations. Milan is

rebuilding and Padua and Turin expanding on the most modern lines. The professors are mostly teachers by career, and are men of great devotion and fine personal qualities. The present low exchange rate has drawn to Italy a great colony of foreign students formerly established in Germany.

Italy has done one interesting and unique thing: she has made engineering a legally closed profession, to all except the graduates of her polytechnics and similar institutions. The first year after graduation is to be spent in subordinate employment, after which a state examination opens the way to professional licensure.

IV.

Switzerland stands supreme in Europe and perhaps in the world in the application of organized intelligence to a severe problem of national economics. Wholly devoid of natural resources, except her soil, an abundance of rock, her modest forest reserves, her water power and her scenery, she is yet the supreme example of evenly distributed modern comfort in her scale of living. Her industrial system, based on the application of the maximum of highly trained intelligence and skill to the minimum of imported raw materials, is a wholly unique example of deliberate economic selection. That is another way of saying that Switzerland is probably the best engineering country in Europe. The famous Polytechnic Institute at Zurich and the numerous technical middle schools which dot the several cantons have been direct factors in this scheme for technical education of all the countries east of the Rhine and maintain their place among the most noteworthy in Europe today.

In Czechoslovakia one finds the leading exponent of the Slavic renaissance. A fair land of fertile plains and forested hills, well endowed with mineral resources, with an intelligent and skilled population, she was the industrial heart of the old Austrian Empire. Today she combines the artistic and intellectual traditions of her own past with an efficiently organized educational system inherited from the Austrian régime.

Czechoslovakia is a sort of back window to Germany and a lookout over Russia, the land of mystery. The Czechs look with misgivings on the fairly obvious preparations of the Germans for the economic exploitation of Russia. They are making an open bid for American sympathy and financial support. They appear to us to use them as a spear-head for any penetration we may wish to make into Russia. They want our support as a counterpoise to Germany and France in the struggle to dominate the Slavic world.

No other European people, unless perhaps the Germans, are so deeply interested in all things American as the Czechs. As an example, it is said that more copies of the report on Waste in Industry made by the American Engineering Council have been circulated in Czechoslovakia than in America itself. The Czech technical schools are decidedly strong in civil and mechanical engineering. There is no dearth of notable professors such as Melan and Doerfel, and they serve with great devotion for meagre salaries, although the material facilities are of the most modest nature. Herein is the greatest contrast to our American schools, incomparably rich in equipment, but far too often staffed with second-rate men.

V.

And now we turn to Germany, for the American observer by far the most interesting, if not always the most agreeable area in Europe. As seen last spring, it was far from an even picture, ranging from gloom and depression at Cologne and Aachen to buoyancy and confidence at Berlin. Physically and materially Germany is strikingly free from visible scars. Her people appear solid and well fed. They have all the rudiments of modest comfort and they have them well distributed. Luxuries are few. In her present state, the bicycle rather than the automobile is the symbol of an economic margin.

Industrial Germany must be pictured as a powerful economic machine, expanded during the war and rehabilitated during the inflation period. She lacks only working capital, raw materials and markets to rival our own industrial system.

There are very plain signs of a five-fold program of economic recovery.

The first item of this program is the development and exploitation of technical knowledge, which the Germans are now pursuing with redoubled zeal. The second item is access to the surplus food supplies and raw materials of Russia. The third item is access to the markets of the East and South, which calls for the wholesale levelling of the economic barriers by which she is now surrounded. The fourth item is the attraction of working capital from the American money market, to offset her own tightly restricted credit. The fifth item of the program is what the Germans characteristically call *Fordismus,* an abstract noun which turns Henry Ford and his famous methods of production into a complete philosophy of industry.

Germany is poor, it is plain enough, but not too poor to expand and strengthen her higher technical education to a most impressive degree. Probably this expansion of plant and equipment is part of a national policy to fix and preserve the liquid wealth of the Reich in a form such that the only possible reparations which can be exacted must be as a surplus of production over Germany's own elemental needs. She gives the impression of being desperately poor in private wealth and immensely rich in collective wealth as employed in education, industry and transport. If she can use all this machinery to advantage she will fortify her world position and insure her economic future by the very operations of the reparations plan.

I can only suggest as a bare catalog the salient features of her higher technical education—the rather exceptional qualifications of the professors, largely drawn into teaching from practice instead of being promoted up an academic ladder; the free régime of work, under which the student comes and goes as he pleases; the absence of a fixed curriculum, but in its place two comprehensive groups of examinations to be passed; the three characteristic types of instruction—lectures, practical exercises and semi-independent projects of analysis

and design; the simplicity of the scheme of organization, with its absence of detail records and disciplinary regulations; the large amount of original work in progress in the laboratories and the correspondingly numerous doctor candidates; the unique resources of certain laboratories which have grown up through the coöperation of the industries and the state with particular professors of wide reputation; the strong emphasis given to training in engineering design; the absence of the textbook and cookbook laboratory system; the growing interest in student housing and welfare; the rudimentary beginnings of a system of athletics and other student activities; the persistence of the duelling system—it is a theme that needs an entire paper to do it justice.

The great and outstanding fact about German technical education is its tremendous expansion. Taken as a whole higher education in Germany was somewhat less in volume in 1924 than in 1914, just before the war. Enrollment under the faculties of medicine, dentistry, theology, the humanities, the mathematical and physical sciences declined greatly. Law and economic science made appreciable gains. In the same period chemistry, pharmacy, and the several divisions of engineering virtually doubled. Of this technical group civil engineering was the only branch to show a considerable decline. Mechanical and electrical engineering enrollments are practically quadruple the pre-war figures.

The outlook for civil engineering is not considered attractive. Transport facilities are highly developed and have been largely renovated since the war. The inflation period led to a building boom from which the country has since reacted. There will be little money for large projects of civil construction for a long time to come and still less to exploit concessions in other lands and so make jobs for German civil engineers.

The great gain in enrollment in electrical and mechanical engineering is indicative of the immense development in manufacturing and the intensive mechanization of agriculture on which Germany stakes her economic future. Germany has learned the stern economic necessity of pulling together. She

is facing her problem in a wholly concerted manner. The inflation period enabled her to liquidate all internal debts and write down her capital accounts to a very low level, in consequence of which she is able to bid for business in the international market with practical disregard of overhead costs. The whole country seems to have made up its mind that the most hopeful outlook for a career for a young German is in the manufacturing industries, with the result that these branches of engineering are attracting the greater part of the group who under the old régime would have sought officers' careers in the army or navy.

It seems plain, however, that Germany cannot possibly absorb all her young engineers at home without degrading many of them to menial positions. One hears, for example, of young Ph.D.'s in chemistry doing common labor in brick and tile yards. In all probability she will send abroad large numbers of young engineers to serve as the advance agents of her economic penetration. Our young engineers will be face to face with them in every foreign market, and they may be face to face with them in no small numbers in our own industries.

VI.

The shortness of our time will compel us to fly over Belgium and Holland without a stop, in order to dwell for a brief period in Britain before coming to our conclusion. Britain is indeed a sad picture. She is on her feet, but bewildered and shaken. She has vast reserves of wealth and power, but her self-confidence and self-sufficiency are faltering. It is a new experience for Britain to come out of a war weaker and poorer. You will recall that the industrial revolution in Great Britain came during a period when continental Europe was disrupted by the French revolution and the Napoleonic wars. In this period Britain gained an immense preëminence in manufacuring and world trade. She solidified her empire and fortified her position by the control of international banking.

The recent war, however, sent all the competitors in world markets back to scratch. Our own industrial system and that

of the continental countries was greatly expanded to meet the demands of war. The peace found the world with greatly enlarged producing power and greatly diminished buying power. Currencies were depreciated, shipping was overbuilt, ocean carrying fell off, marine motive power went over from Welsh coal, Scotch boilers and British engines to foreign oil fuel and continental Diesel motors. For a country like England where only one person in seventeen lives on the soil, the effect of dislocation of world trade is simply staggering.

No doubt there will be recovery, at least in part, as normal conditions return on the continent. But Britain is beginning to scrutinize her industrial set-up, and with it her system of technical education, with a new and critical seriousness. British engineering and British industry have a great tradition of practicality. An engineer has been regarded as a practical builder, primarily the product of the factory, the mine or the field of civil construction, with enough native curiosity and energy to get some insight into the science underlying his craft. Until quite recently there had been a distinct divorce between university education and engineering. Universities were supposed to be for gentlemen and scholars, while engineers were presumed to be neither, in the narrow and technical sense of the oft-used terms. Of course, there were notable exceptions, like Sir Charles Parsons, but for the most part higher technical training was looked upon with doubtful favor by the dominant men in the engineering profession.

The great genius of Britain in the field of technical education has been expressed in its numerous local technical schools, which serve mostly as continuation centers to supplement training through practical apprenticeship. Education of this type has very substantial virtues, as the results of the Lowell School here at the Institute will testify, but it has one fundamental defect—it tends to dissociate engineering training from high scientific culture and research. In recent years British industry has begun to suffer obviously from this divorce from science. There is now a marked tendency to foster university work in engineering and applied science. Laboratory facili-

ties are being improved, graduate students are multiplying, and engineering research is being pushed concertedly and with vigor. It remains to be seen whether this movement may not have come too late. The British tradition of muddling through dies very slowly. As one of her discerning professors put the matter, Britain is par excellence the land of trial and error. Given unlimited time to make adjustments, trial and error may be very effective, but the present crisis is one demanding decisive and intelligent action.

VII.

By way of summary and conclusion, let us recapitulate some of the more striking contrasts between higher technical education here and abroad.

1. We have an unbalanced and top-heavy system, the result of imitation and the absence of any coördinating control comparable to the European ministries of education.

2. Because our system is top-heavy, a good deal of it is pretentious. An insatiate craving for prestige, even though it may be hollow, and uncritical emotionalism characterize too much of our entire scheme of higher education. In comparison, European educators are realists.

3. We have little to learn abroad as to material equipment, except in a few special laboratories in Germany. We might learn, however, how far short we fall of getting the full possibilities out of our investment.

4. We are in real danger of exalting material equipment and perfection of teaching routine above men, as the foundation of our work. Getting the men is apparently harder than getting the things. It is partly a matter of compensation, of salaries above the level of meanness, but it is far more a matter of the nature and circumstances of our type of professional career, and it is most of all a problem of creating a national tradition which gives generous recognition and reward to non-commercial types of achievement. As it is we do not pay in money and we do not know how to pay in honor.

5. We have to compensate for the results of a scheme of

secondary education which, however admirable in its widely inclusive democracy, is comparatively flabby and superficial. In point of mental maturity and discipline, extent of knowledge and capacity for hard work, the European youth of eighteen is nearly two years in advance of our own. By intensive methods and a crowded schedule we recover about half the deficit in our four-year programs and send our graduates out on an approximate par with the product of a three-year program in Great Britain, somewhat behind the product of the best three-year programs in France and practically a year behind the diploma engineer from the four-year programs of Germany, Austria, Switzerland, Holland and the Scandinavian countries.

6. We shall lag in the higher stages of technical education unless we can get our abler students to assume much more initiative. Our whole set-up tends to become a scheme to *give* students an education. Too often our colleges are highly elaborate school-houses, our students are overgrown schoolboys and our professors glorified school-masters. The take-it-or-leave-it program abroad assumes that students are expected to *get themselves* an education, under the guidance of creative men and in an environment of real intellectual production.

7. The American and the British students have a decided advantage over the continental students in physical development through athletics and in general development derived from other extra-curricular activities. Speaking broadly the American graduate fits into the teamwork of business and practical life more readily than the continental diploma engineer, but he is apt to have an inferior grasp of theory and fundamentals and to be less capable of working independently.

8. Training in design by full-scale project work bulks much larger in the continental scheme than in Britain and America. Our men get a more extended training in shop and laboratory technique, although much of it is deficient in analytical qualities.

9. Continental Europe depends on the higher technical

schools as centers of research and original work far more than America or Great Britain. The large-scale industrial research laboratory is essentially an American institution, and, educationally considered, something of an American handicap.

10. Both professors and students abroad have more freedom than with us. Professors work under an ethical code which obligates them to devote all their efforts to the advancement of their special fields of knowledge. Their fixed appointments are fewer, but they direct a volume of work limited only by their creative ability and their power to draw disciples about them. Except in France and Italy, students abroad are free to attend or stay away. They work on long-range assignments of work rather than day-to-day installments. Examinations of comprehensive scope, rather than detailed daily records, are the measure of their achievement and progress.

In conclusion, I find myself drawn to the conviction that we have a program of technical education which is well suited to a considerable group of our students of a medium grade of ability. The present program is plainly too long and too complex for a large group of lower powers. But there is a third group, not large and probably not as large as it should be, young men of high native ability and mental energy. We need a better program, a freer program, for these men and in providing for them we have most to learn from our colleagues across the Atlantic.

JUNIOR COLLEGES AND TECHNICAL INSTITUTES.*

BY JOHN T. FAIG,

President, Ohio Mechanics Institute, Cincinnati, O.

The article on junior colleges, in ENGINEERING EDUCATION for December, 1925, pages 333 to 337, by Dr. George F. Zook, defines in a few words one conception of the part that junior colleges may be called upon to play in the educational policy of the country. Dr. Zook writes that generally the junior colleges offer the first two years of a liberal arts college, and he develops this thought at some length. He then speaks of the field of semi-professional education, which is a subject much less understood, the present writer believes, than junior colleges. He mentions a few institutions in which curricula especially intended to develop men for semi-professional positions are operative, and discusses briefly the need for and possibilities of this semi-professional training. Dr. Zook's paper is followed by another on the subject of the junior college, by Mr. L. W. Clark, who discusses the junior college from the standpoint of the professor of engineering. In other words, Mr. Clark considers the junior college solely as a preparatory school for an engineering college.

Perhaps it is proper to call attention here to the fact that Dr. Zook has mentioned two kinds of training which are quite different from each other. There is no assurance that these two kinds of training can be followed successfully in the same institution and with the same instructors. The present writer has discovered that some engineers and engineering teachers have the notion that an institution may be at once a junior college which prepares students for the engineering colleges, and an institute which gives finishing courses of the kind Dr. Zook describes as semi-professional courses. These latter

* Discussion of "Junior Colleges," December, 1925, JOURNAL OF ENGINEERING EDUCATION.

courses have for many years been offered by institutions that are now generally known as technical institutes, though that name has not universal acceptance. Such courses were given long before the term "junior college" was a familiar one. The student who takes such a course is frequently a man who has been engaged in mechanical pursuits, and who returns to school to prepare himself for higher responsibilities. He is quite different from the boy who has just completed high school, has never encountered responsibilities, is not sure what he wants to study, and is animated by no strong motivating influence. The technical institute courses, which are similar to those grouped by President Zook under the term "semi-professional courses," are usually intensive and practical in their nature, though this is not to be understood as implying that the students are intended to become mechanics. Such courses have been given in the East for over thirty years, and are now given at a number of institutions in the East and in the Middle West. They have no connection with, and no similarity to, the junior college courses. They are not preparatory courses except as they are preparatory to life and to occupation. They are intended to be finishing courses. The student who desires to continue his education longer than such a course contemplates, is advised to go elsewhere.

As a former professor of engineering subjects for many years, I was quite ignorant of the general purpose and courses offered by the technical institutes, and of the type of student they serve. It is possible that there are many instructors and professors in the engineering colleges who are not better acquainted with technical institutes than I was. That is the reason why I venture here to call attention to the general class of institutions known as technical institutes and to the students who desire the kind of training that Dr. Zook has mentioned as semi-professional education. Engineers and teachers of engineering who have travelled abroad recently and have studied education for engineers abroad tell us that there are relatively many more students abroad than here in the type of institution which is represented in this country by the technical institutes.

It appears to the writer that it is well to heed the need for a type of institution that will train men adequately for the semi-professional jobs. Since the general organization of the technical institute is quite different from that of the junior college, and since the need for technical institutes is apparently great in this country, perhaps some of the junior colleges located in or near industrial centers will do well to consider which of the two kinds is most necessary in their community. The general organization and the equipment for the two will be quite different. The cost of education in a technical institute is quite high because much technical and scientific equipment is necessary, because teachers trained in engineering and industry are necessary, and because the classes may not be as large as they are in academic subjects.

One temptation to the executive of an institution that is trying to find its proper place in the educational scheme is to attempt to develop an institution that is both a junior college and a technical institute. In exceptional cases something of this kind may be possible, but it seems to the present writer that it is best to choose one of these objectives and adhere strictly to it.

There are technical institutes in the eastern part of the United States that have trained students for thirty years. Others are scattered about the country. As a nucleus from which must be developed much of the non-college type of training that is going to be required in this country, technical institutes are worthy of support. Their number should be increased, and engineering professors generally should know more about the kind of courses they give and the objectives for which their students are trained. Many engineering professors lump everything of technical nature outside of the engineering college into the term "trade school." The latter term is a poor one for such institutions. Many students who have not the means or the desire to attend engineering colleges can be given in the technical institutes the technical education they require to become useful men in the industrial world.

THE ENGLISH DEPARTMENT.

Distributing the Load.

BY J. RALEIGH NELSON,

University of Michigan.

If some such well-conceived plan for carefully checking the use of English by students throughout the four years of their college course as that outlined last month by Professor Park were practical in all engineering colleges and under all conditions, the problem of better English for the engineer would be well on the way to solution. Such a plan automatically secures the coöperation of instructors in English and in technical subjects in training the student to habits of correct speech, and an observance of at least the "decencies," in whatever writing he does. But in many schools any plan like this at all complex in the machinery for its administration is quite out of the question. In such schools a willingness to share the responsibility for the students' English, the spirit of genuine, whole-hearted coöperation, must be a matter of slow growth—the achievement of a highly desirable ideal by patient and persistent propaganda.

At Michigan it began with the Dean. Having lived through the lean years when deans in general inclined to wonder why the Committee on English did not, if it were any good at all, report a satisfactory means for securing immediate and better results from the teaching of English, it is a great satisfaction to repeat, that at Michigan, it began with the Dean. Through all his twenty-two years as Dean Professor Cooley has preached the practical value, and the humanistic value of instruction in English, the mastery of a respectable diction as the mark of an educated man. He has preached this saving gospel with the force and directness with which he has preached other things he heartily believed. And for this nearly a quarter century the heads of departments and the men of their staffs

have caught their cue from him. Great weight has also been added to the position of the faculty by a consistent use of alumni opinion. Very definite effort has been made to secure and set before the students the opinions of successful and notable graduates of our college as to the value of English for their professional work. This emphasis on the indispensable value of English as part of a man's equipment for life and especially for professional work, since it has been consistently stressed everywhere and by almost everyone with whom the student comes in contact, has created an atmosphere very favorable to the work of the English department. The instructors in English have never had to "sell" their subject to an unwilling public. Students have been quite ready to coöperate with their instructors in the interest of better English.

If only every dean and every faculty would determine to relieve its English staff of the embarrassment of selling its wares, and would so conspire to stress the need for decent habits of speech, and a reasonable respect for the use of one's native tongue, that students generally came to their classes in English eager for what they could get—a condition of prime importance would be assured for the success of whatever instruction in English is given.

Fortunately, having exalted the importance of training in English as a part of the student's preparation, the Dean did not leave the entire responsibility for securing correct speech habits on the staff of the English department. I have seen the day when many an engineering faculty felt its entire duty done when it introduced a three- or four-hour course in English in the curriculum of the freshman year. That one poor little freshman course was expected to eliminate the evidences of illiterate home surroundings, to counteract bad preparatory teaching, to develop an ability on the part of the student to think straight and write clearly, to provide some systematic training in public speaking, and so charm the freshman student with the beauties of English literature that he would bear by some magic process evidences of "culture" and liberal

training henceforth and forever. It is fortunately some years since it was supposed that an engineering course could be liberalized by introducing a few hours of non-technical studies. It is now quite fully appreciated that only as all his work is taught him by men with a sense of background and vision and a sense of the human and social values of the subjects taught can a student receive a liberalizing education. I dare say it will be many years before such an ideal of inspired, humanistic teaching will be actually realized in our engineering colleges. It need not be discouraging therefore to note how little as yet do the members of our faculties appreciate their mutual and common responsibility in the matter of student English. However, until every instructor is willing, and is expected as part of his duty to his students, to correct their slovenly habits of speech and the inaccuracies of their written usage, the average student will speak and write in the presence of his English instructor as he knows he must in order to get his credit in English, and then will indulge in the freedom of writing as he likes in his technical courses. At Michigan there has been a growing willingness on the part of all the faculty to share this responsibility. Most encouraging is the frank appreciation of the fact that it is an obligation, and that only by the coöperation of everyone contributing to the student's training can he be given the habits of speech of an educated man.

The staff of the English department at Michigan, in return for the sympathy and whole-hearted support it has received from the faculty, has always held itself ready to coöperate wherever it could to secure better results in the technical courses. It has usually waited patiently and with some tact till the suggestion came from technical departments desiring help. But it has tried to act on such suggestions promptly and efficiently. Two illustrations of a definite sort will show how, without any great amount of machinery, coöperative effort has been secured.

Three or four of the more experienced men on the English staff were delegated to assist the instructors in certain junior or senior courses demanding a considerable amount of writing.

These men were chosen because they were specially qualified; they were assigned this coöperative work as part of their recognized teaching load. At the beginning of the semester these instructors in English gave one talk to the students with whom they were to work. They explained that they were to be for this semester in a position to help them with the written work required for the course. They gave them a style sheet, and explained in some detail the requirements for the type of paper to be prepared. They then announced their general plan, which was as follows: Every student was to confer with the instructor in English in his office and must present to him a plan for his paper in outline and have it approved as a satisfactory plan by the instructor in English before the paper was written. After the paper was set up in proper form, it was to be corrected by the instructor in English and revised or even rewritten, if it was deemed best, before it was submitted to the instructor in the technical course. The student was not to be graded on the English. There was no penalty for poor English composition nor any reward for special excellence on English. The student was simply required to take full advantage of the opportunities for securing the criticism and help he needed.

I need hardly add that this plan worked. Many a boy learned more about writing than he had ever learned from his formal courses in English composition.

The course in Report-Writing which we have given for the seniors for the past fifteen years is another example of how naturally and easily a course in English may be made to correlate with the work in the technical departments of instruction. Originally this course was purely elective, but it has gradually come into the list of requirements for a number of departments so that now it is required for all Civils, all Marines, practically all Chemicals and most Mechanicals. The course consists of lectures, exercises and a number of brief progress reports, but the major assignments are two in number and are, whenever possible, the theses or major reports prepared for the technical courses. The assignment of the sub-

jects for these two major reports is made wherever possible by the professor in charge of the student's engineering course. The student then does all his work in the preparation of the report under my direction. His plan, his bibliography, his rough draft are all submitted for criticism. The report in its final form is revised and rewritten till it is as nearly as possible in the form we deem satisfactory.

These are but two examples of numerous ways in which at Michigan the training of the student in English has been correlated with the technical work he is pursuing. For a variety of reasons which we do not need to detail, no such elaborate system of correlation as that so successfully administered at the University of Cincinnati has seemed practical with us. But as the sense of responsibility for the inculcating in our students of correct habits of English usage deepens in the minds of all our faculty, the load is being more equitably distributed.

The prerequisites for a satisfactory solution of the problem of better student English seem to be: first, a dean and faculty genuinely convinced that the ability to write and speak correctly is a vital necessity for their students, and willing not only to preach this gospel in season and out of season, but to share the burden of responsibility in seeing it realized; and, second, a staff of instructors in English committed to the interests of engineering education whole-heartedly, identified with the engineering faculty in every way, and inspired with the spirit of coöperation and the vision of the dignity of their service. These are the essential conditions. The ways and means must in the nature of the case be for some years more or less experimental.

STANDARDIZATION OF DRAFTING ROOM PRACTICE.

Last year the American Society of Mechanical Engineers requested the American Engineering Standards Committee to take up the question of standardization for drawings and drawing office practice. On December 4th the American Standards Committee called a conference in New York at which representatives from some twenty-five National associations, and others from colleges and large companies, a total of fifty-three, were present. Professor R. S. Kirby represented the S. P. E. E.

After the presentation of a summary of an investigation of the present variations in commercial practice by Mr. F. W. Ming and a resumé of standardization already accomplished by foreign national standardizing bodies by Mr. John Gaillard, the following resolution was unanimously adopted:

Resolved: That, the consensus of opinion of this conference is that standardization of drawings and drafting room practice under the auspices of the A. E. S. C. is desirable.

A special committee was then appointed to consider sponsorship and formulate scope. This committee submitted an agenda covering substantially the outline as proposed by the Standards Committee, and recommended as joint sponsors, the A. S. M. E. and the S. P. E. E.

This Society has accepted the joint sponsorship and President Pegram has appointed Thos. E. French of The Ohio State University as representative.

COLLEGE NOTES.

Syracuse University.—The 25th anniversary of the College of Applied Science, Syracuse University, will be celebrated on February 16th by a student and alumni dinner at Hotel Syracuse.

Among the guests and speakers on this occasion will be Col. Robert I. Rees, Assistant Vice-President of the American Telephone & Telegraph Co., Mr. Calvin W. Rice, Secretary of the American Society of Mechanical Engineers, and Dr. Charles W. Flint, Chancellor of Syracuse University.

The University of Wisconsin.—Dr. Burt L. Newkirk, Research Engineer of the General Electric Company, made a lecture tour into the North Central Region last December. He spoke on "Shaft Behavior" before students in the engineering schools of the Universities of Illinois, Minnesota, Ohio, Wisconsin, and of Purdue University; on "The Mercury Turbine" before the Electrical Board of Trade of St. Louis; and on "Engineering Research" before the Affiliated Engineering Societies of that city.